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TWO NEW *SONORELLA* FROM SONORA, MEXICO, AND NOTES ON SOUTHERN LIMIT OF GENUS

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The southern limit of distribution of *Sonorella* has never been established, even vaguely. In the state of Chihuahua, Mexico, Pilsbry found *Sonorella mormonum* Pils. at Lat. 30° 19' N, and *S. pennelli* Pils. slightly farther south at Lat. 30° 09' N. In Sonora, *S. magdalenensis* (Stearns) was found ca. Lat. 30° 39' N, near Magdalena. I have found *S. nixonii* W.B. Miller as far south as Nacozari, ca. Lat. 30° 22' N.

Investigating ever farther south, I have found populations of *Sonorella* in the region of Moctezuma and Huasabas, Sonora. A population east of Huasabas, ca. Lat. 29° 56' N, is a new subspecies of *mormonum*, while a population east of Moctezuma, ca. Lat. 29° 53' N, is a new species, related to *mormonum*. Both are described below.

Still farther southwest, on the road from Moctezuma to Hermosillo, I have found a population of *S. sitiens montezuma* P.&F. (the subspecific name refers to Montezuma canyon in Arizona) just west of Moctezuma, ca. Lat. 29° 45' N; and a population of *S. magdalenensis*, ca. Lat. 29° 25' N, some 24 road miles east of Ures. To the best of my knowledge, the latter is the most southerly known locality for *Sonorella* to date.

Collecting still farther to the south, in the vicinity of El Novillo, on the banks of the Rio Yaqui, ca. Lat. 28° 54' N, and Sahuaripa, ca. Lat. 29° 03' N, I failed to find any *Sonorella* at all. Instead, several undescribed species of *Holospira*, *Bulimulus*, and *Euglandina* characterize the area, thereby indicating a different faunal province. Also, the vegetation is primarily tropical thorn scrub, rather unlike the preferred oak-woodland and Lower Sonoran habitats of *Sonorella*. Admittedly, *magdalenensis*, in the vicinity of Ures, seems to have adapted to some rock-slides in tropical thorn scrub, but these are drier and sparser than the usual thorn scrub farther south. Accordingly, based on present, incomplete evidence,

the probability of finding *Sonorella* south of a line drawn easterly from Hermosillo through Sahuaripa, ca. Lat. 29° N. would be small. Dr. Stillman Berry expressed a similar opinion to me, several years ago, before I had begun any explorations in the area.

SONORELLA MORMONUM HUASABASENSIS new subspecies. Plate 1, figs. A-C.

Description: Shell moderately depressed-globose, heliciform, thin, glossy, light brown, with chestnut-brown spiral band on the well-rounded shoulder; narrowly umbilicate, the umbilicus contained 10 times in the diameter. Embryonic shell of about 1 and $\frac{1}{4}$ whorls; its apex, the first $\frac{1}{4}$ of the embryonic shell, is finely, radially wrinkled; over the second $\frac{1}{4}$, the wrinkles break up into papillae and the radial pattern begins to descend spirally toward the suture; over the second $\frac{1}{2}$, the spiral papillae have united to form fine threads; those above the shoulder ascend toward the upper suture, while those below the shoulder descend toward the lower suture, forming the usual *hachitana* pattern of ascending and descending spiral threads; the space between threads is finely, radially wrinkled; over the last $\frac{1}{4}$ of the embryonic shell, the spiral striae have diverged far apart and some begin to break up into long hyphen-like papillae; they end abruptly at the end of the embryonic shell. Remainder of shell, at first, finely, radially wrinkled, with small papillae and scars of deciduous, periostracal, hairlike processes; later, over the the body whorl, the scars are absent, the radial wrinkles are smooth, and the periostracum has a silky luster. The last whorl descends moderately in front. The aperture is rounded, the peristome narrowly expanded in the outer and basal margins; parietal callus thin.

Holotype measurements: Height 9.4 mm.; max. diam. 14.9 mm.; umbilicus 1.5 mm.; whorls $4\frac{1}{4}$.

Measurements of genitalia, in mm.

	Holotype	Paratype B	Paratype E
Penis	7.0	7.5	7.0
Verge	3.5	3.5	3.0
Penial sheath	4.5	3.0	4.0
Epiphallus	8.0	8.0	8.5
Epiphallic caecum	1.0	1.0	1.0
Vagina	7.0	5.5	7.0
Free oviduct	3.0	3.0	3.5

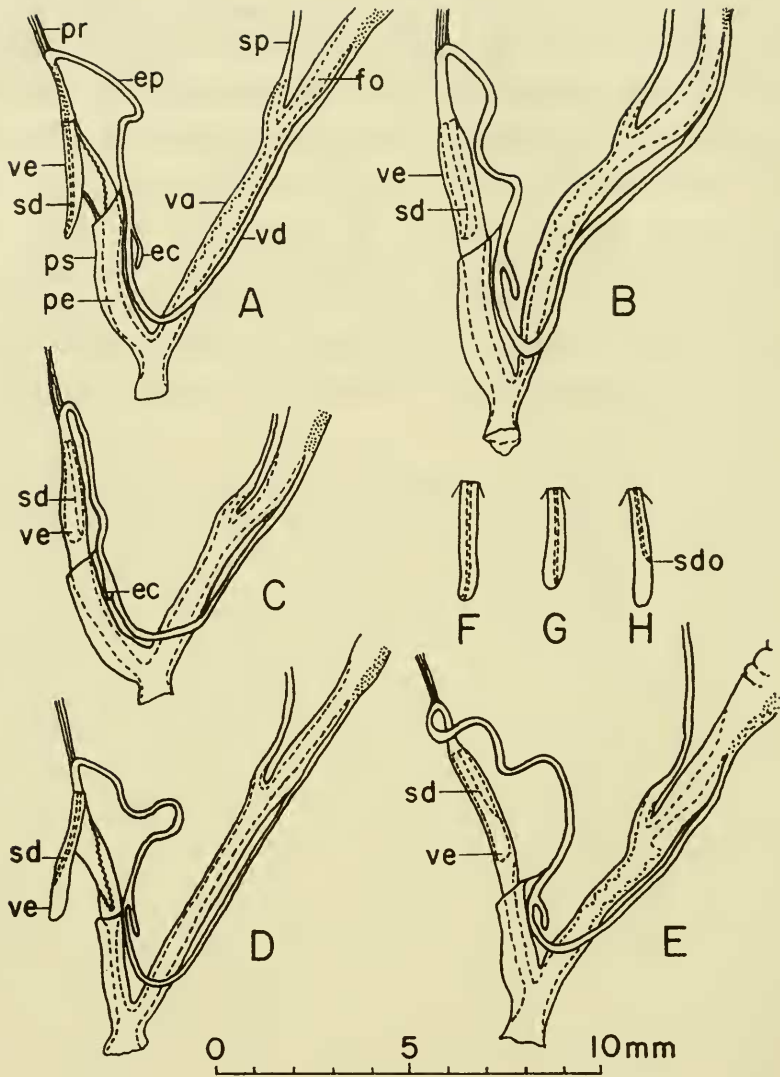
Genitalia of holotype (Page 4, figs A, B): The moderately long

penis contains a slender, cylindrical verge of about $\frac{1}{2}$ the length of the penis, blunt at the end. The seminal duct opens at the tip of the verge in a shallow depression. Penial sheath slightly longer than $\frac{1}{2}$ the length of the penis. There is a well-developed, detached epiphallic caecum. The vagina is about as long as the penis.

Type locality: Sonora, Mexico, in NW facing rockslides about 5 miles east of Huasabas along the road from Huasabas to Bavispe; elev. ca. 3600 ft. (W. N. Miller and W. B. Miller, 1 Sept. 1965). Holotype ANSP. (312763). Paratypes in collections of ANSP. (312764), Dept. of Zoology, University of Arizona (2819), and the author (4821).

This subspecies closely resembles nominate *S. mormonum* Pilsbry, in the shape and sculpture of the shell, as well as in the morphology of the genitalia. It differs from *mormonum* by the presence of a well-developed, detached epiphallic caecum, and by the larger diameter of the shell. The epiphallic caecum was observed in all 6 dissected specimens of *huasabasensis*; whereas it was vestigial in all 6 dissected topotypes of *mormonum* (Page 4, fig. C). The larger diameter of the shell of *huasabasensis* was determined to be significantly different from that of *mormonum* by statistical analysis. A sample of 24 adult specimens from the topotype population of *mormonum* was compared with a sample of 52 adult specimens of *huasabasensis*. Contrary to the usual high variance in shell diameter of most species of *Sonorella*, *mormonum* and *m. huasabasensis* show a high degree of homogeneity. The mean diameter of *mormonum* was 14.2 mm., with a minimum of 13.3, a maximum of 15.1 and a standard deviation of .433; the mean diameter of *huasabasensis* was 15.4 mm., with a minimum of 14.5, a maximum of 16.8 and a standard deviation of .567. Student's *t* was calculated to be 10.1, thereby indicating a significant difference in shell diameter in the two populations at a confidence level greater than 99.9%.

S.m. huasabasensis lives in large rock-slides on the western slope and near the top of the nameless mountain range just east of the Rio de Bavispe near Huasabas. This locality is about 65 airline miles southwest of the type locality of *mormonum*. The vegetation around the slide is lower Sonoran, consisting mainly of *Condalia*, *Lycium*, sotol, coral bean, and occasional *Quercus chihuahuana*.



Lower genitalia. A. *Sonorella mormonum huasabasensis* W.B. Miller, holotype; penis cut open to show verge. B. *S.m. huasabasensis*, paratype 4821-E. C. *S. mormonum* Pilsbry, topotype 4901-B. D. *S. perhirsuta* W.B. Miller, holotype; penis cut open to show verge. E. *S. perhirsuta*, paratype 4824-B. F. Verge of *huasabasensis* 4821-E. G. Verge of *mormonum* 4901-B. H. Verge of *perhirsuta* 4824-B. ec, epiphallic caecum; ep, epiphallus; fo, free oviduct; pe, penis; drawings to scale indicated, from stained whole mounts.

pr, penial retractor; ps, penial sheath; sd, seminal duct; sdo, seminal duct orifice; sp, spermathecal duct; va, vagina; vd, vas deferens; ve, verge. All

SONORELLA PERHIRSUTA new species.

Plate 1, figs. D-F.

Description: Shell moderately depressed-globose, heliciform, thin, hirsute, light brown, with chestnut-brown spiral band on the well-rounded shoulder; narrowly umbilicate, the umbilicus contained

9 to 10 times in the diameter. Embryonic shell of about 1 and $\frac{1}{4}$ whorls; its apex smooth, followed by rough radial wrinkles over the first $\frac{1}{3}$ whorl; next $\frac{1}{3}$ whorl with well-developed, widely spaced, descending spiral threads, between which fine wrinkles lie perpendicular to the spiral threads; remainder of embryonic shell with raised papillae superimposed on fine radial wrinkles. Later whorls, including body whorl, with raised growth striae, fine radial wrinkles, and papillae from which project short, periostracal hair-like processes. The periostracal processes are worn off in places, but are mostly persistent all the way to the peristome and into the umbilicus. The last whorl descends moderately in front. The aperture is rounded, the peristome narrowly expanded; parietal callus thin.

Holotype measurements: Height 9.0 mm.; max. diam. 15.1 mm.; umbilicus 1.6 mm.; whorls $4\frac{1}{4}$.

Genitalia of holotype (Page 4, figs. D, E): The moderately long penis contains a slender, cylindric verge of about $\frac{1}{2}$ the length of the penis, blunt at the end. The seminal duct opens at the side of the verge, at about $\frac{2}{3}$ to $\frac{3}{4}$ the length of the verge. Penial sheath about $\frac{1}{2}$ the length of the penis. Epiphallus about $1\frac{1}{2}$ times the length of the penis. There is a well-developed, detached, epiphallic caecum. The vagina is about as long as the penis.

Measurements of
genitalia, in mm.

	Holotype	Paratype B	Paratype D
Penis	6.5	6.5	7.0
Verge	3.5	3.0	3.5
Penial sheath	3.0	3.0	3.5
Epiphallus	10.0	9.5	11.5
Epiphallic caecum	0.7	0.7	1.0
Vagina	7.0	5.5	5.0
Free oviduct	3.0	2.5	2.5

Type locality: Sonora, Mexico, in mountains between Moctezuma and Huasabas, about 2 miles north of the Moctezuma-Huasabas road at a point 16.8 road miles east of Moctezuma, in granite rock piles in ravine on the north-east face of the high peak; elev. ca. 4650 ft. (W. N. Miller and W. B. Miller, 2 Sept. 1965). Holotype ANSP. (312765). Paratypes in collection of Dept. of Zoology, University of Arizona (2820), and the author (4824).

S. perhirsuta is closely related to *S. mormonum* Pils. and *S.m. huasabasensis*, W. B. Miller. It differs from them by the anatomy

of the verge, in that the seminal duct orifice is not terminal, and by the long epiphallus. It has a well-developed epiphallic caecum, as in *huasabasensis*. In shell characteristics, it differs by the lack of ascending spiral threads on its embryonic shell and by the persistent periostracal processes on adult shells; such hirsute appearance on adult *Sonorella* shells has been reported only from *S. apache* P.&F. and *S. greggi* W. B. Miller.

S. perhirsuta is known only from the holotype and seven paratypes. The smallest adult paratype measures 13.4 mm. in diameter and the largest 16.1 mm. It lives in the Upper Sonoran life zone among small, granite rock-piles in ravines. Vegetation was mainly *Quercus oblongifolia*, *Q. chihuahuana*, sotol, yucca, coral bean, and a profusion of wild zinnias in bloom. Heavy humus contributed to the early decomposition of dead shells.

A NEW HAWAIIAN CYPRAEA

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It has become apparent through study of recently collected beach and living shells from the Hawaiian Islands that a distinct cowrie has been heretofore overlooked. This cowrie is superficially similar to *Cypraea globulus* Linn. 1758, and *Cypraea bistrinotata* Sch.-Sch. 1937; but it also resembles *Cypraea cicercula* Linn. 1758.

CYPRAEA MAUIENSIS Burgess, new species.

Plate 2.

The holotype is inflated and globular; the dorsum is humped posteriorly, colored tan to pale lemon-pulp yellow, and there is no dorsal sulcus. The dorsum is adorned with tiny discrete elevations, some of which are pigmented, and which are larger, darker and more prominent near the lateral margins and extremities of the shell. There are 3 paired brown dorsal blotches, one pair just above the spire, the second on the mid-dorsum, and the third above the anterior process, and 4 faint brown terminal spots. On the base, at the marginal extremities near the anterior and posterior canals, are 4 faint brown blotches. The extremities are blunt and only moderately produced. The aperture is narrow, slightly curved to the left posteriorly, and does not flare anteriorly. There is a large flat callus above the posterior canal and above this is a shallow depression. The spire is slightly elevated, even in calloused shells, but there is no blotch. The protoconch, when not covered by callus, is transparent. The teeth are fine, and in the mid-columella